Title:	VAULT SEARCH AND SECURE PROCEDURE		
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1.0 PURPOSE

In general the search and secure (SAS) procedure is to have a searcher methodically search the Cyclotron Vault to look for people, hazardous conditions and to check the operational readiness of equipment. Once the searcher has verified that the Vault is ready for operation, then the searcher will secure the Vault to prevent anyone from reentering the Vault.

The intent of this procedure is to ensure that, when the Cyclotron and/or its Radio Frequency System (RF System) are operating, the Cyclotron staff and visitors are excluded from the Cyclotron Vault, thereby protecting them from prompt radiation in the Vault.

The scope of this procedure includes having the searcher physically closing the Cyclotron Vault, searching the Vault to ensure no one remains in the Vault, and inspecting the Vault to ensure it appears ready for safe Cyclotron operation, and then the searcher leaves and secures the Vault. , and finally the searcher logs the result of the search in the Cyclotron Operation Logbook in the Control Room.

Present Cyclotron Policy dictates that if three or more people enter the Vault, both inner and outer gates must be opened, dropping the search chain, and requiring a full search of the Vault before operating the Cyclotron. If the Operator in Charge (OIC) has any doubt about the presence of people in the Vault, the OIC **must** search and secure the Vault before operating the Cyclotron or RF system.

2.0 QUALIFICATION

This procedure is performed by a trained person familiar with the normal Cyclotron operational practices and the normal configurations of the Cyclotron equipment.

This procedure is to be performed by a qualified radiation worker or Cyclotron Operator (a second radiation worker, operator, or a trainee, may accompany the qualified worker for safety or training purposes only.) Only people trained in this procedure may search and secure the Vault.

This procedure may be performed by the persons who have completed NSD1004 “Vault Search and Secure Procedure” training. The EH&S Training Reports database may be checked to find the names of the persons that have completed the required training for this procedure.

3.0 HAZARD REVIEW

The performance of this procedure should not subject personnel to increased hazards above those associated with entering a controlled area. Upon entering controlled areas the searcher must follow the established facility safety practices.

The performance of this procedure may subject personnel to the following potential hazards:

Radiation:

Hazard: If the deflectors are operating at high voltage, be aware of possible x rays emitting from the area of the south port window of the Cyclotron and the deflector cage. When there is any deflector leakage current, there will be measurable x-ray emission from the deflector area. The intensity is worse at high deflector voltages.

Mitigation: Consider running the three Deflector Power Supplies to zero volts output to eliminate the possibility of high x-ray fields near the Cyclotron Deflectors. During the SAS keep your distance from the deflector area and the south port window. ALARA policy dictates that you move safely and smartly through these areas to minimize any x-ray exposure.

4.0 PROCEDURE

4.1 Search and Secure Preparation:

4.1.1. Verify the area to be SAS is ready to be secured and all work in the area has been completed.

4.1.2. Secure or verify the Cyclotron operation has been secured by having the OIC open the 12kV breaker.

4.1.3. Prepare a Vault SAS checklist. The searcher will use the SAS checklist as an aide to the performance of the procedure. Complete the checklist as the procedure is performed and insert the completed checklist in the Cyclotron Operations Logbook. A Vault SAS checklist is shown in Attachment A.

4.1.4. Take a VAULT Castell key from the CONTROL ROOM TRANSFER KEYS panel.

4.1.5. Close the south Vault door or verify that the south Vault door is closed.

4.2 Search and Secure the Vault:

To search and secure the Cyclotron Vault, proceed as follows:

4.2.1.1. Enter the Vault: At the west Vault door, review the Vault Radiation Survey form to identify areas with-in the Vault that exhibit measurable radiation levels.

4.2.1.2. Enter the Vault through the open west Vault door, sliding the outer screen gate closed after you enter.

4.2.1.3. Using the controlled area gate key open the inner gate, enter the Vault and close the inner west gate behind you.

NOTE

Both west outer and inner gates must be closed to operate the Vault search chain system.

The white Vault lighting lights will remain on throughout the search. These lights are essential for safe movement through, and an adequate search of, the Vault.

4.2.2.1. Search the Vault: Beginning at the search station at the NW corner of the Vault, proceed from search station to search station, around the Cyclotron and returning to the west door.

4.2.2.2. Search for any people. Ask any people in the Vault to leave. If anyone is found in the Vault, the search must start over with step 4.2.1.1., after they have left.

4.2.2.3. Search for any unsafe condition that exists or that could impair the safe and proper operation of the Cyclotron. Correct any safety concerns or operational readiness concerns found. The search must start over, return to step 4.2.1.1., after they have been corrected.

4.2.2.4. At each of the five search stations:

1) Check that each RUN-SAFE switch is set to RUN;

2) Check that each amber beehive light glows, Replace defective lamps as they are found (the RUN-SAFE switch must be in RUN mode), begin the SAS, go to step 4.2.1.1., if interrupted by defective parts replacement;

3) Press the VAULT INSPECTION switch lamp, check that both upper PRImary and lower SECondary lamps glow;

4.2.2.5. Near the south Vault door verify that the south Vault door inner and outer gates are fully closed.

4.2.2.6. The fifth and last search station in the Vault is on the North wall of the Vault by the west exit.

4.2.2.7. Open the inner west gate and leave the Vault, closing the inner gate behind you.

4.2.2.8. Open the outer west gate and leave the Vault passageway, closing the outer gate behind you.

4.2.3. Secure the Vault: At the Vault door control panel press the VAULT INSPECTION switch lamp. Verify that when the switch lamp is pressed, the PRImary VAULT INSPECTION switch lamp *and* the SECondary VAULT INSPECTION switch lamp glow, the white lights in the Vault switch off, and the red fluorescent lighting in the Vault switches on.

4.2.3.1. If the PRI and SEC switch lamps glow, close the west Vault concrete door. Once the door is fully closed, press the Vault door PUMP OFF switch.

NOTE

While the door pump will switch off automatically after several minutes, it is good practice to switch off the pump manually as soon as the door is fully closed, and not to rely on the automatic pump cutoff switch.

4.2.3.2. Return the Vault Castell keys to the CONTROL ROOM TRANSFER KEY panel. Insert the keys in the switches labeled VAULT, and turn the key to the full cw position.

4.2.3.3. At the Safety Chain Interlock Panel verify that the lamp labeled WEST VAULT DOOR R-S glows and that the lamp labeled VAULT XFER KEYS IN glows.

4.2.3.4. Record the time that the Vault SAS was completed and sign the entry in the Cyclotron Operation Logbook.

NOTE

If three or more people enter the Vault at one time, after the SAS was completed, **both the inner and outer gates must be opened. When all the people have left the Vault the OIC must do a new SAS of the Vault.**

5.0 RECORDS

Records generated by the performance of this procedure are to be in compliance with RPM, Section 1.18, Records Management. Records generated through implementation of this procedure consist of the entry in the Cyclotron Operations Logbook indicating the signature of the searcher and the time of the completion of the SAS. I n addition the completed SAS checklist is kept in the Cyclotron Operations Logbook. The Cyclotron Operations Logbook is maintained in the control room by the Operations Supervisor.

6.0 REVIEW OF PROCEDURE

Under the guidelines for DOE Order 420.2B, this procedure will be reviewed at least once every three years, or sooner if changes occur that may impact the appropriateness or implementation of this procedure.

REVISION HISTORY

11 July 1996: Updated and approved as V2.0 due to engineering changes in the Vault Search and Secure chain, and the addition of the redundant interlock chain in the Vault.

1 June 2006: 88-PRO-004 was updated and approved as V 3.0 to reflect current operating practices and implementation.

7.0 GLOSSARY

ALARA Policy: The LBL ALARA (As-Low-As Reasonably-Achievable) Policy for personal radiation exposure. For the Laboratory ALARA policy see LBL Publication 3000 Section 21.3: ALARA Program at Berkeley Lab.

SAFETY CHAIN INTERLOCK PANEL: The Cyclotron Radiation Safety Chain Interlock Panel located in the Control Room at rack A2111.

OIC: Operator-in-Charge

RF SYSTEM: The Radio Frequency System, the source of energy used to accelerate the ion beam inside the Cyclotron. RF energy creates the voltage on the dee electrode that accelerates injected ions and may accelerate stray ions (dark currents).

SEARCHER: A person qualified to execute this Procedure, usually the Cyclotron Operator in Charge or another qualified Cyclotron staff member, who will clear, search, and secure the Cyclotron Vault and record the fact in the Operation Logbook.

VAULT INSPECTION SWITCH LAMP: These are two part switch lamps located at each search station. They have two internal lamps. The upper lamp indicates the status of the PRImary interlock chain; the lower lamp, the status of the SECondary interlock chain. Both should glow once the switch lamp is pressed (assuming the search station's RUN-SAFE switch is in a safe state). Failure of either VAULT INSPECTION switch lamp to reset (indicated by either switch lamp *not glowing*), indicates there is a break in the inspection reset chain. The break is usually an open RUN-SAFE switch, an opened gate, or because someone has entered the Vault, nullifying this search: Clear the Vault and begin again.

8.0 REFERENCES

1. LBL Publication 3000: Health and Safety Manual, Section 21.
2. LBL Publication 3113, LBL Radiological Control Manual.
3. DOE Order: DOE O 420.2B, *Safety of Accelerator Facilities*

9.0 ATTACHMENT

Attachment A: Vault Search and Secure Checklist. Changes to the checklist do not warrant a revision of the procedure.

Attachment A
Vault Search and Secure Checklist

Initial what was completed. ND- Not Done NA- Not Applicable Page_____

Search and Secure Checklist Date:_____

Preparation	Vault	Pit	Tren	01/02	1	2	3	4	4A	4B	4C
Ask all personel to leave the area											
Search	Vault	Pit	Tren	01/02	1	2	3	4	4A	4B	4C
Enter area closing chain protected doors / gates behind you											
Search and ensure all people are out of the area											
Proceed around the area, press chain inspection lights											
Verify primary (up) & secondary (dn) inspection lights on											
Verify all area doors, hatches and gates are shut											
Verify "Run-Safe" switches are in the "Run" position											
Verify Amber beehive & emergency door open button glows											
Search the area for any unsafe conditions											
Search for any condition that will preclude safe operation											
Verify beam plug shielding is adequate & undisturbed											
Verify shielding bricks are in place in the escape ways.											
Ask experimenter about any temporary shielding.											
Verify beamline devices are working											
Resolve any problems encountered											
After problems are resolved begin SAS again											
Secure	Vault	Pit	Tren	01/02	1	2	3	4	4A	4B	4C
Exit area and close doors / gates behind you											
Return door key to control room											
Record	Vault	Pit	Tren	01/02	1	2	3	4	4A	4B	4C
Record SAS and sign entry in Control Room log book											